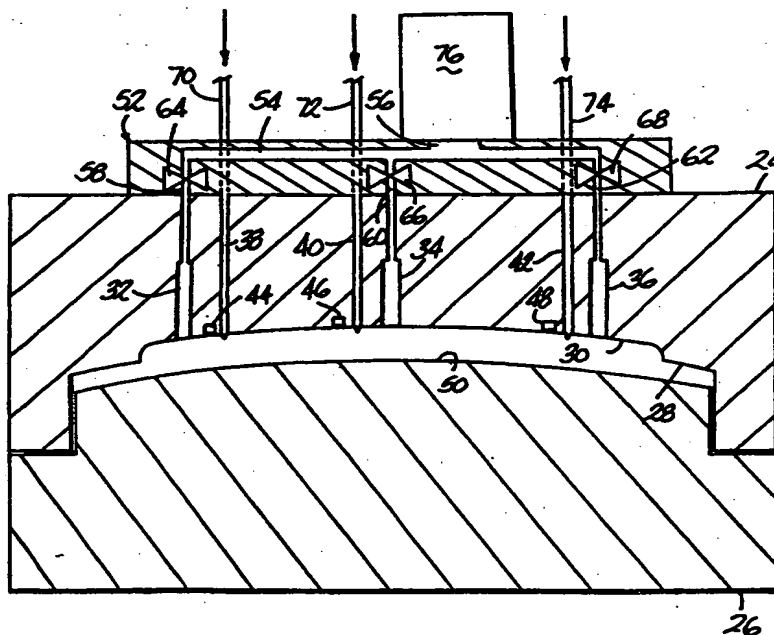




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : B29C 45/00, 45/17, 65/00, B62D 29/04		A3	(11) International Publication Number: WO 98/39150
			(43) International Publication Date: 11 September 1998 (11.09.98)
(21) International Application Number: PCT/US98/04517		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).	
(22) International Filing Date: 6 March 1998 (06.03.98)			
(30) Priority Data: 60/040,338 7 March 1997 (07.03.97) US 08/914,684 19 August 1997 (19.08.97) US			
(71) Applicant (for all designated States except US): CASCADE ENGINEERING, INC. [US/US]; 5141 - 36th Street, S.E., Grand Rapids, MI 49512 (US).			
(72) Inventors; and		Published With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.	
(75) Inventors/Applicants (for US only): KELLER, Frederick, P. [US/US]; 5545 Hall, S.E., Grand Rapids, MI 49546 (US). MISNER, John, E. [US/US]; 3288 Earle, S.W., Grandville, MI 49418 (US). FILD, Daniel, J. [US/US]; 3689 Oakbluff Drive, Grand Rapids, MI 49546 (US).		(88) Date of publication of the international search report: 18 February 1999 (18.02.99)	
(74) Agent: McGARRY, John, E.; Rader, Fishman, Grauer & McGarry, Suite 600, 171 Monroe Avenue, N.W., Grand Rapids, MI 49503 (US).			

(54) Title: GAS-ASSISTED INJECTION MOLDING OF LARGE PANELS WITH SEQUENTIAL GATING



(57) Abstract

Molding of relatively large articles such as automobile body parts by gas-assisted injection molding with sequential gating of injected thermoplastic resin into the mold cavity. Elongated ribs in the parts form gas channels and strengthening ribs for the parts. Structural parts are made by adhesively joining two such parts made by gas-assisted injection molding through a combination of hollow ribs and joining flanges at sides of the parts.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakhstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 98/04517

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 B29C45/00 B29C45/17 B29C65/00 B62D29/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 B29C B62D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0 043 174 A (STAMICARBON) 6 January 1982 see the whole document ---	1,2,4-8, 10-16, 18-20,26
Y	EP 0 630 731 A (HETTINGA SIEBOLT) 28 December 1994 see the whole document ---	1,2,5,6, 8,11,13, 15,16, 19,20
Y	MICHAELI W ET AL: "KASKADENSPRITZGIESSEN ANALYSIERT UND MIT CADMOULD BERECHNET" PLASTVERARBEITER, vol. 45, no. 11, November 1994, page 96, 98, 100, 102 XP000482361 see the whole document --- -/-	1,2,5,6, 8,11,13, 15,16, 19,20

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention.
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "Z" document member of the same patent family

Date of the actual completion of the international search

25 June 1998

Date of mailing of the international search report

22.12.98

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl.
Fax: (+31-70) 340-3016

Authorized officer

BOLLEN, J

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 98/04517

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	GAULER KURT: "BINDENÄHTE VON SPRITZGIESSTEILEN BESEITIGEN" PLASTVERARBEITER., vol. 37, no. 10, October 1986, SPEYER/RHEIN DE, pages 226-228, XP002069379 see the whole document ---	1,2,5,6, 8,11,13, 15,16, 19,20
Y	FR 2 702 990 A (EUROSTYLE) 30 September 1994 see page 5, line 15 - line 24; figure 2 ---	1,4,7, 10-12, 14,15, 18,26
Y	RUSCH K.C.: "PLASTICS IN AUTOMOBILES" February 1989, SOC. OF AUTOMOTIVE ENGINEERS INC., WARRENDALE XP002069380 16572 see page 155 - page 162 ---	1,4, 10-12, 14,15, 18,26
Y	US 5 401 459 A (NICHOLS JAMES M ET AL) 28 March 1995 see the whole document -----	1,4, 10-12, 14,15, 18,26

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 98/04517

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. Claims 1-27: Molding large articles by sequential injection of resin and injection of a gas.
 2. Claims 28-36: Article assembled from injection molded shells with bonding surfaces having ribs with a hollow gas channel.
-
1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
 2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
 3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
 4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-27

Remark on Protest

☐
☐

The additional search fees were accompanied by the applicant's protest.

No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 98/04517

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
EP 0043174	A	06-01-1982	NL	8003800 A	01-02-1982
			JP	57045039 A	13-03-1982

EP 0630731	A	28-12-1994	DE	630731 T	24-08-1995

FR 2702990	A	30-09-1994	NONE		

US 5401459	A	28-03-1995	US	5716163 A	10-02-1998
